Industrial Technologies Program

Separation Of Olefin/Paraffin Mixtures With Carrier-Facilitated Transport Membranes

Use of Membranes Could Significantly Reduce Energy Costs

Olefins, a group of petrochemicals that includes ethylene and propylene, are the primary building blocks for the petrochemical industry. Nearly 84 billion pounds of olefins are produced annually by steam cracking of ethane, propane, or naphtha. Although steam crackers are effective, the distillation processes used to separate ethylene/ethane and propylene/propane mixtures are highly energy intensive, consuming an estimated 120 trillion Btu per year.

A three-company consortium - Membrane Technology and Research, Inc., ABB Lummus Global, and SRI International - is working with DOE to develop membranes that perform an initial bulk separation that could cut the cost of distillation in half and reduce the cost of ethylene and propylene production by two to six cents per pound. This represents a 10-20% cost reduction based on current prices of ethylene ($0.28/lb) and propylene ($0.20/lb).

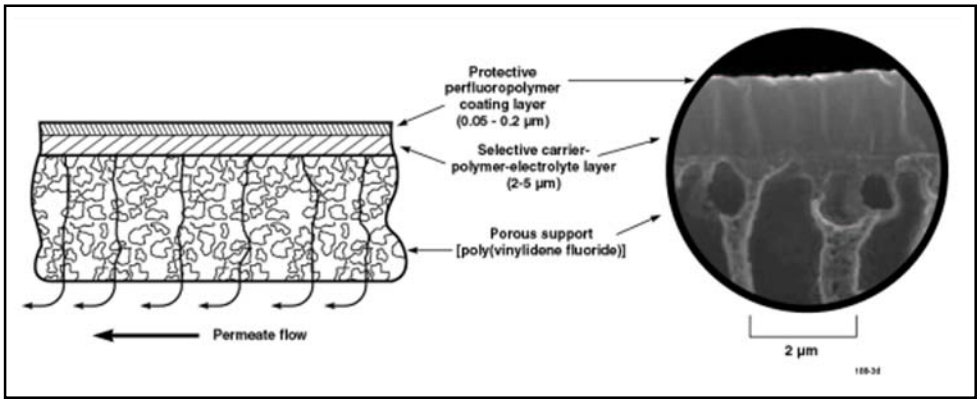

Fig. 1: Schematic drawing and electron micrograph of a solid-state facilitated transport membrane.

Benefits

By 2020:

- *Savings of 48 trillion Btu per year*

Applications

Developing membranes that perform an initial bulk separation of ethylene/ethane and propylene/propane mixtures could cut the cost of distillation in half and reduce of the cost of ethylene and propylene production by two to six cents per pound.

Project Partners

- *Membrane Technology and Research, Inc.*
- *ABB Lummus Global*
- *SRI International*

Project Description

Goal: The overall goal of this project is to complete the development and scale-up of facilitated transport membranes that can separate olefin/paraffin mixtures efficiently and economically.

The new membranes will incorporate an olefin carrier that is dissolved into a solid polymer electrolyte. The olefin carrier facilitates olefin transport, and the result is a membrane with improved mechanical stability over conventional carrier-facilitated membranes.

Activities: Experiments will demonstrate that membranes with the required stability can be made on an industrial scale and fabricated into spiral-wound membrane modules. These experiments will also demonstrate the ability of pilot-scale membrane module systems to achieve the performance and lifetime required at operating field test sites.

Researchers will select the optimum applications for the demonstration phase of the project and prepare a realistic plan to introduce the technology to the industry.

Progress and Milestones

Year 1 Milestones:

- Complete membrane evaluations
- Select the best membrane-carrier combinations for scale-up
- Establish preliminary module performance targets
- Establish readiness to begin bench-scale membrane module tests

Year 2 Milestones:

- Complete bench-scale membrane module evaluations
- Select the best membrane-carrier combination for pilot-scale field tests
- Establish readiness to begin field tests

Year 3 Milestones:

- Obtain field test results
- Prepare technoeconomic evaluation of the proposed process flow schemes
- File patents

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